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Suzuki

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(54) **FLOW VOLUME DETECTOR**

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G01F 15/02	(2006.01)

(52) **U.S. Cl.**
CPC ***G01F 1/58*** (2013.01); ***A61M 1/16*** (2013.01); ***A61M 1/1647*** (2014.02); ***G01F 1/588*** (2013.01); ***G01F 15/02*** (2013.01); *A61M 2205/3317* (2013.01); *A61M 2205/3324* (2013.01); *A61M 2205/3334* (2013.01); *A61M 2205/3368* (2013.01)

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USPC 73/204.12, 204.13, 861.11, 1.25, 861.52, 73/861.63, 204.18, 204.19, 204.26
See application file for complete search history.

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(57) **ABSTRACT**

A base (**41**) includes a plurality of flow channels (**33**, **34**) and detection sections (**531**, **541**) for detecting the flow volumes of fluids flowing in the flow channels (**33**, **34**). In the base (**41**), a blocking section (**57**) for blocking heat conduction between the flow channels (**33**, **34**) is provided between the flow channels (**33**, **34**). The blocking section (**57**) is configured of groove (**58**) formed in the base (**41**).

8 Claims, 8 Drawing Sheets

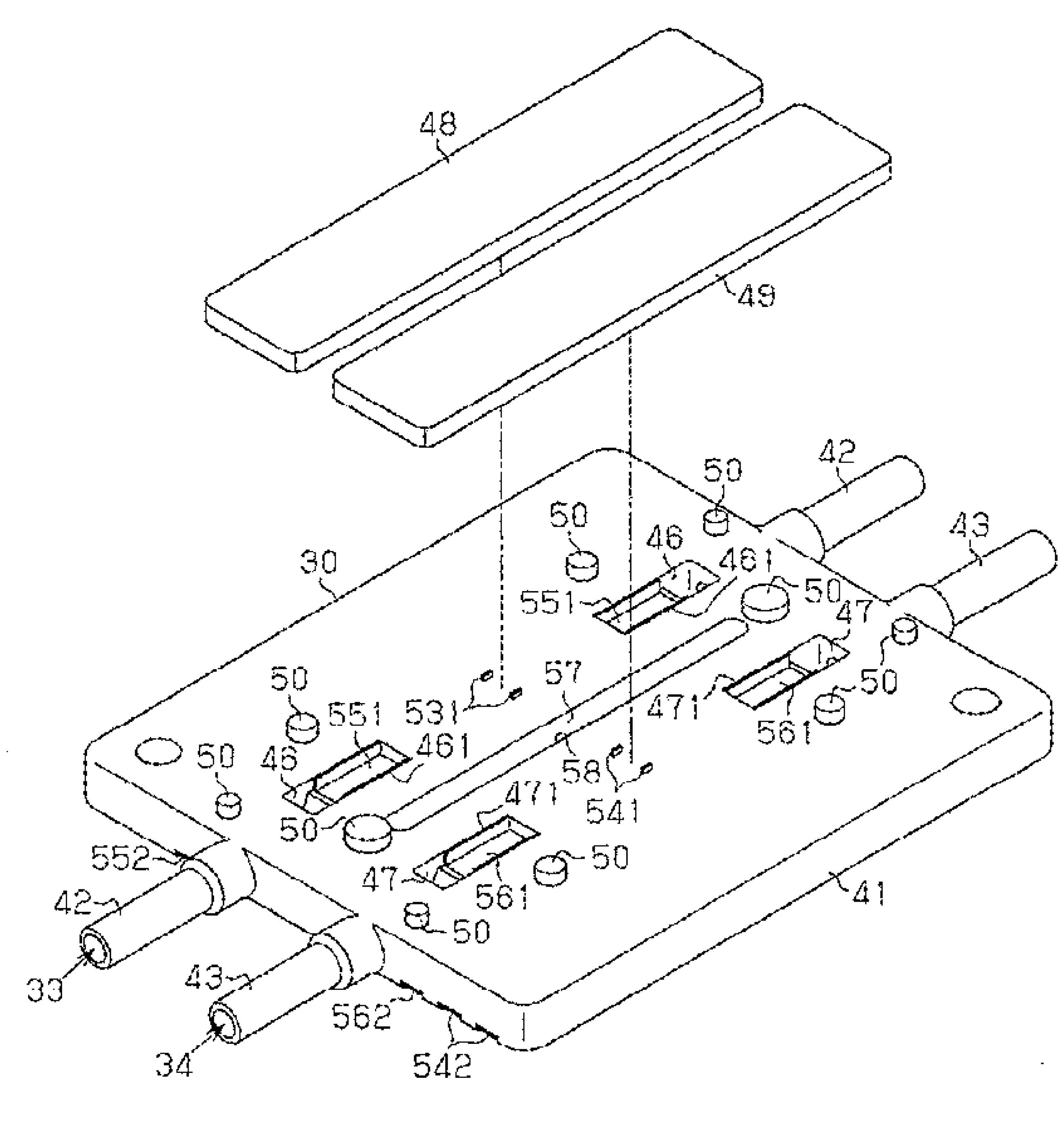

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Fig.1

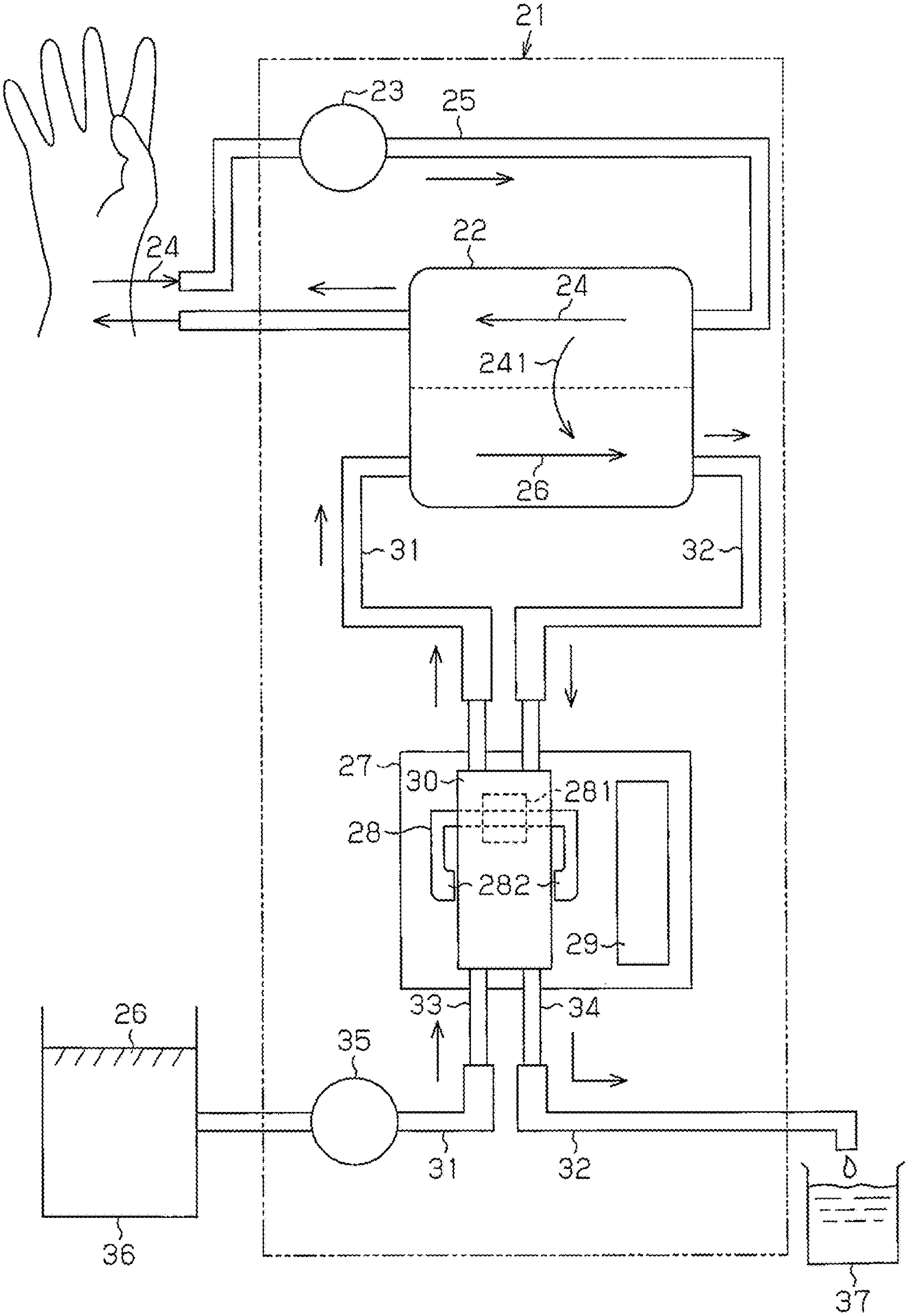

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Fig.2

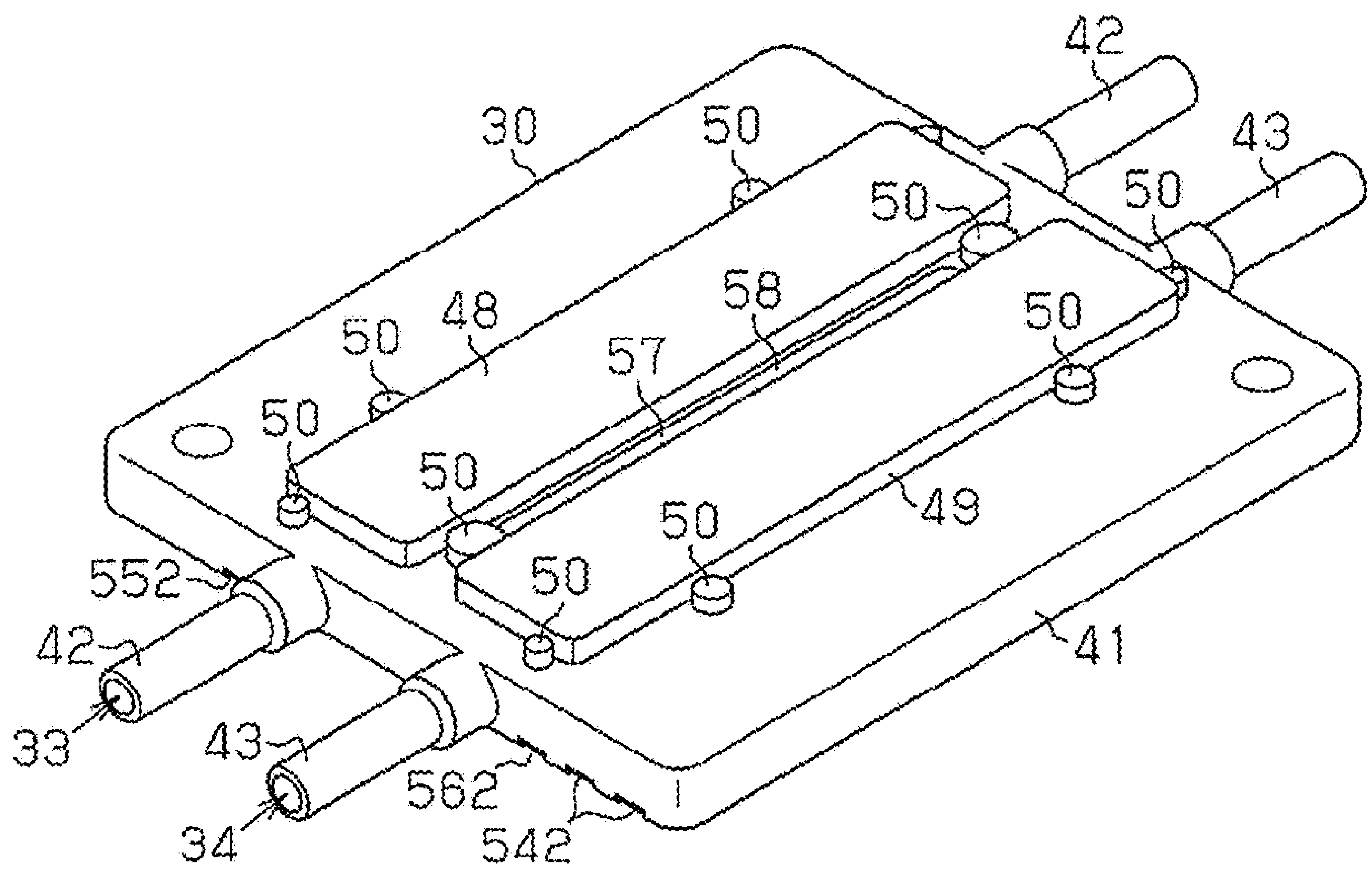

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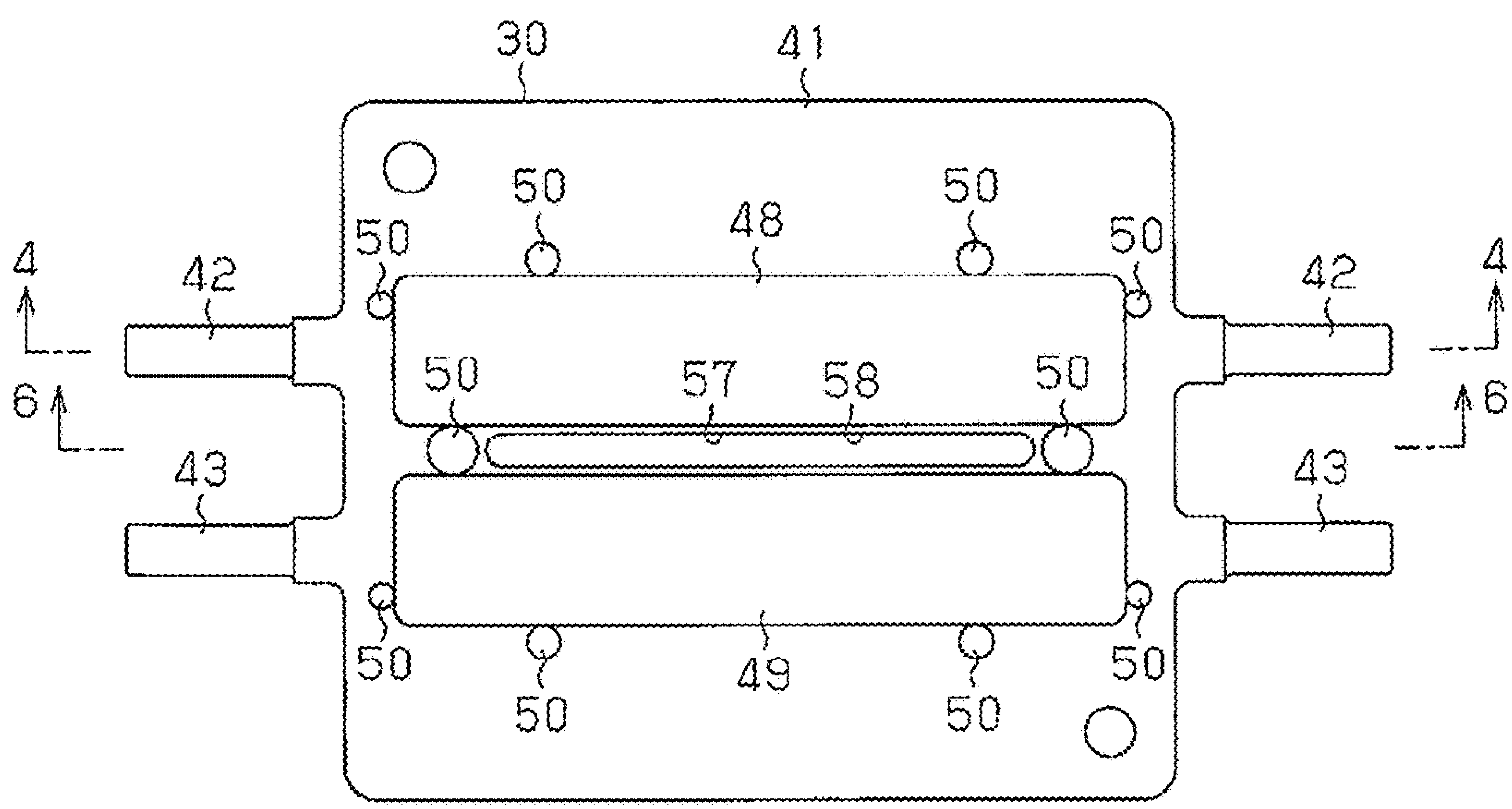
Fig.3



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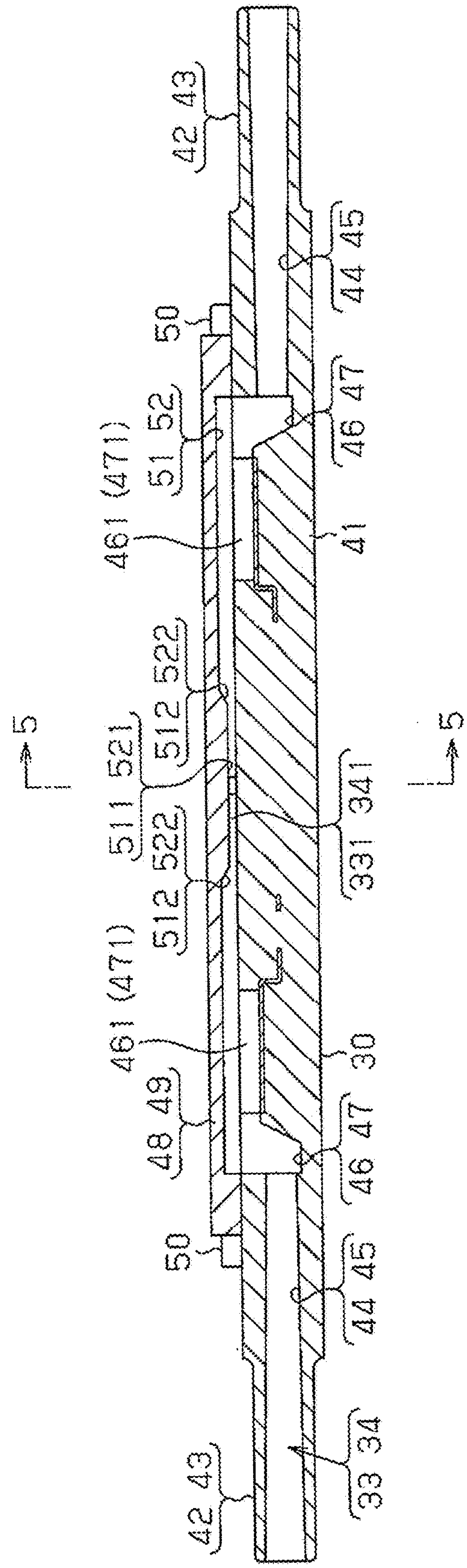
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Fig.4

Fig.5

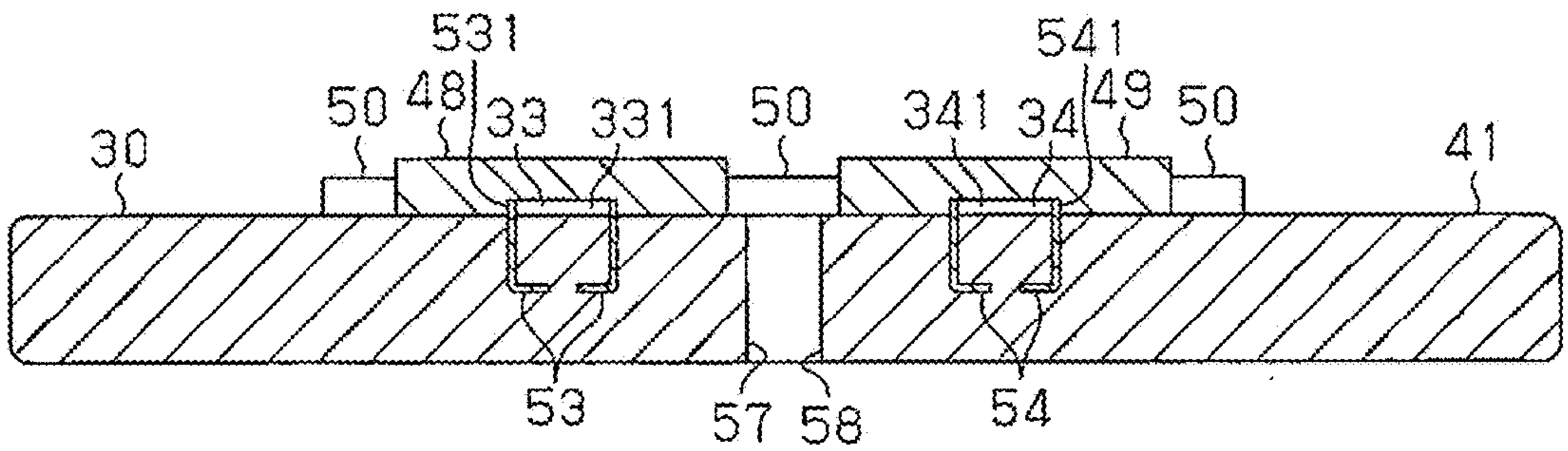
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Fig.6

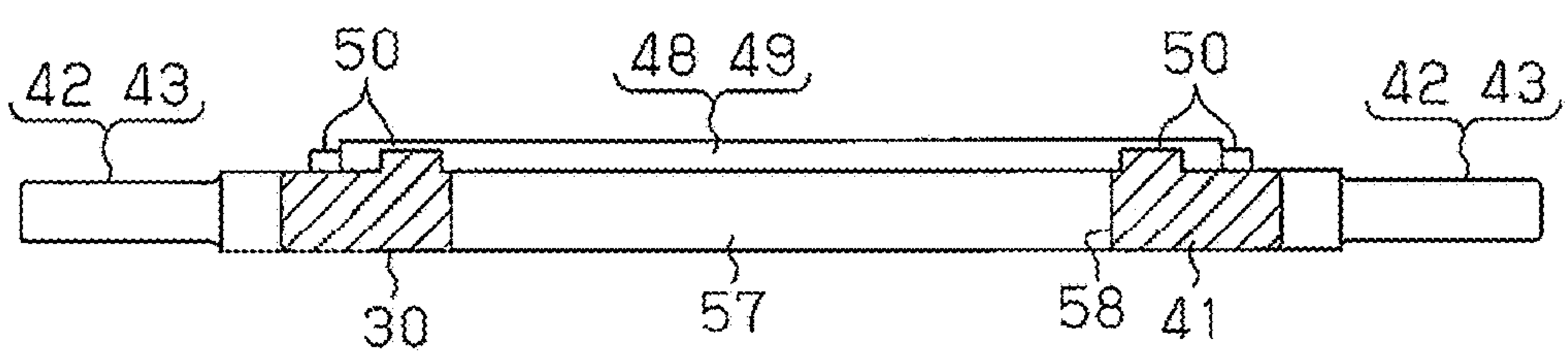
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Fig.7

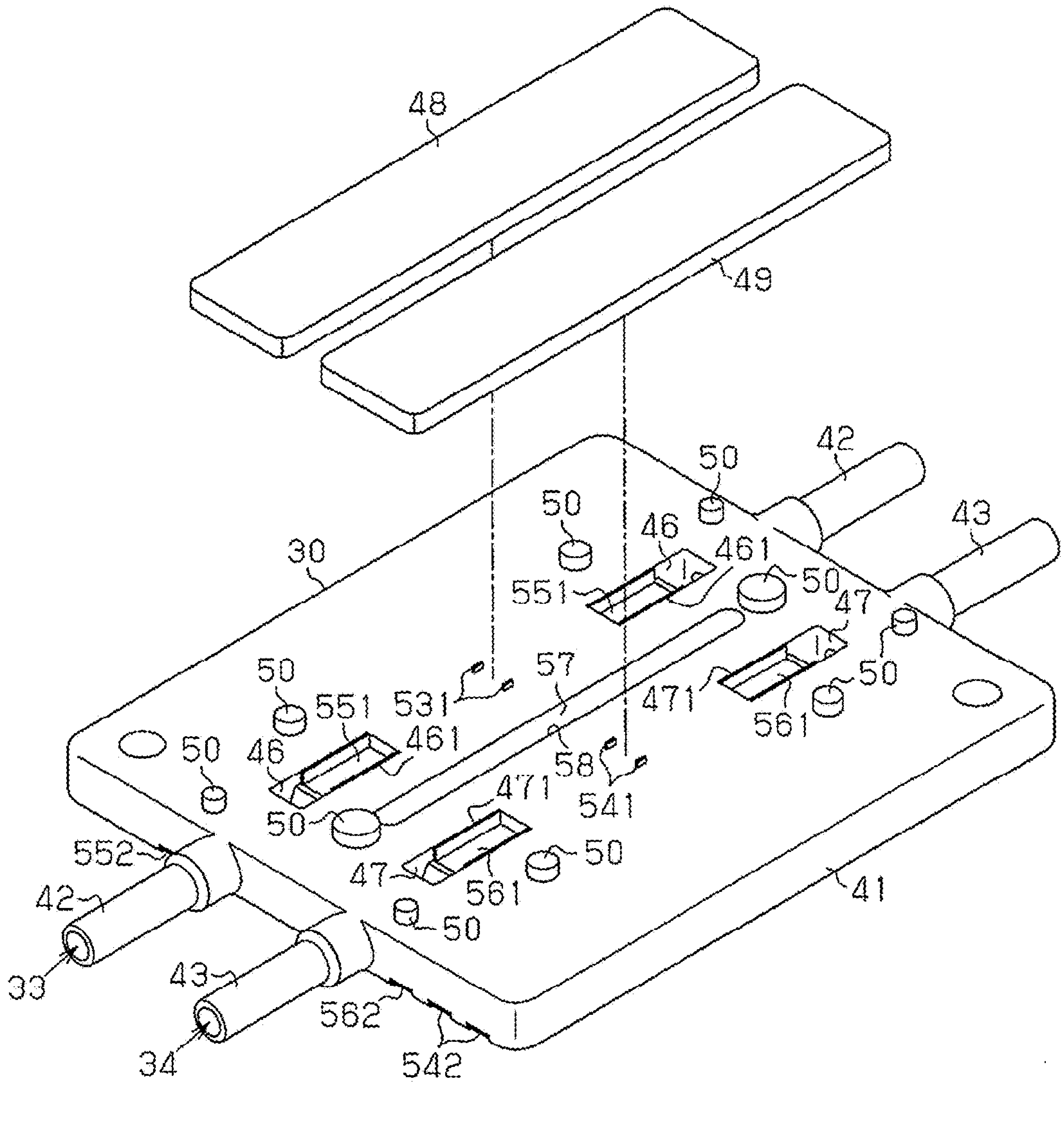
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Fig.8

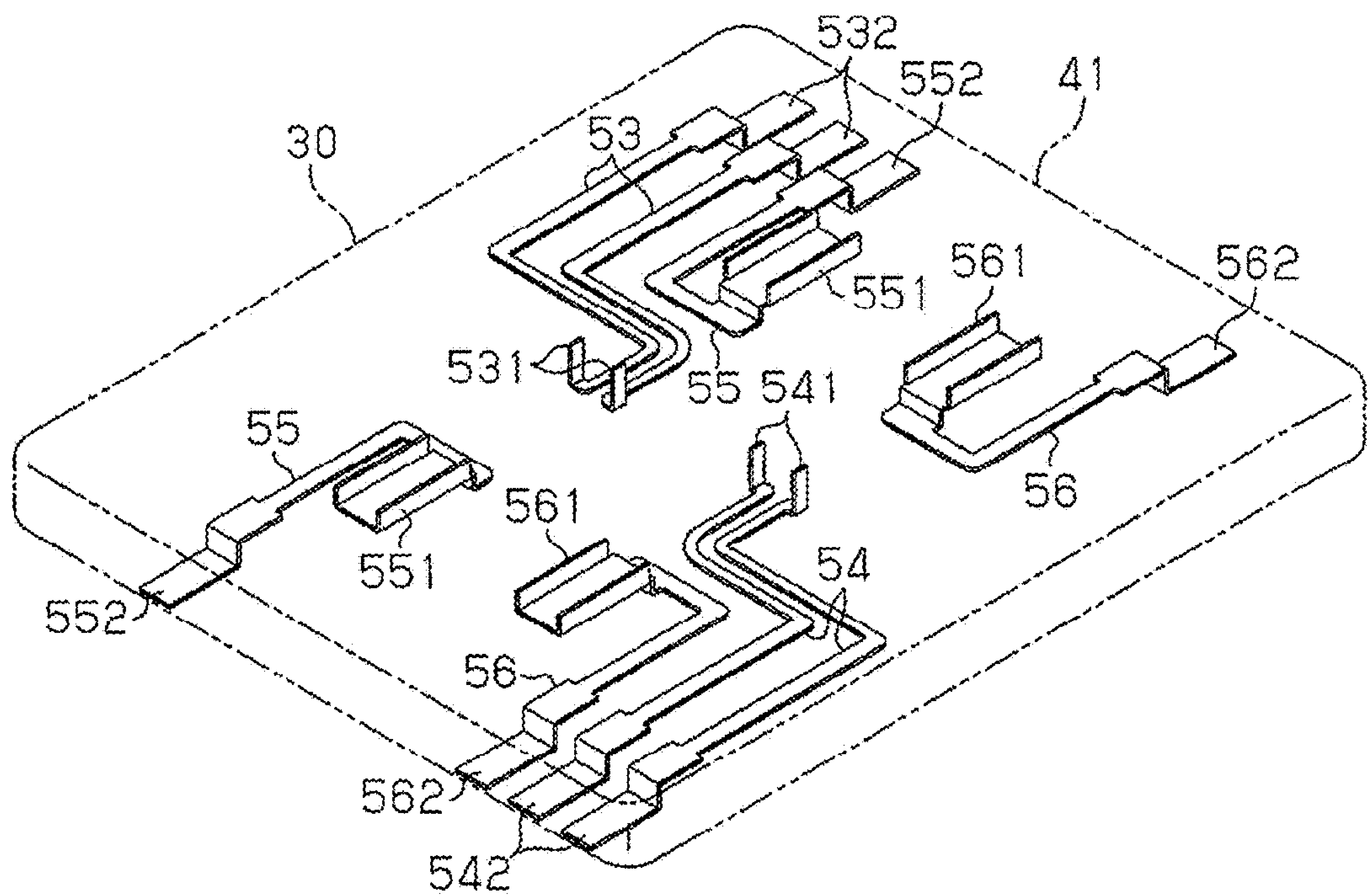

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Fig.9

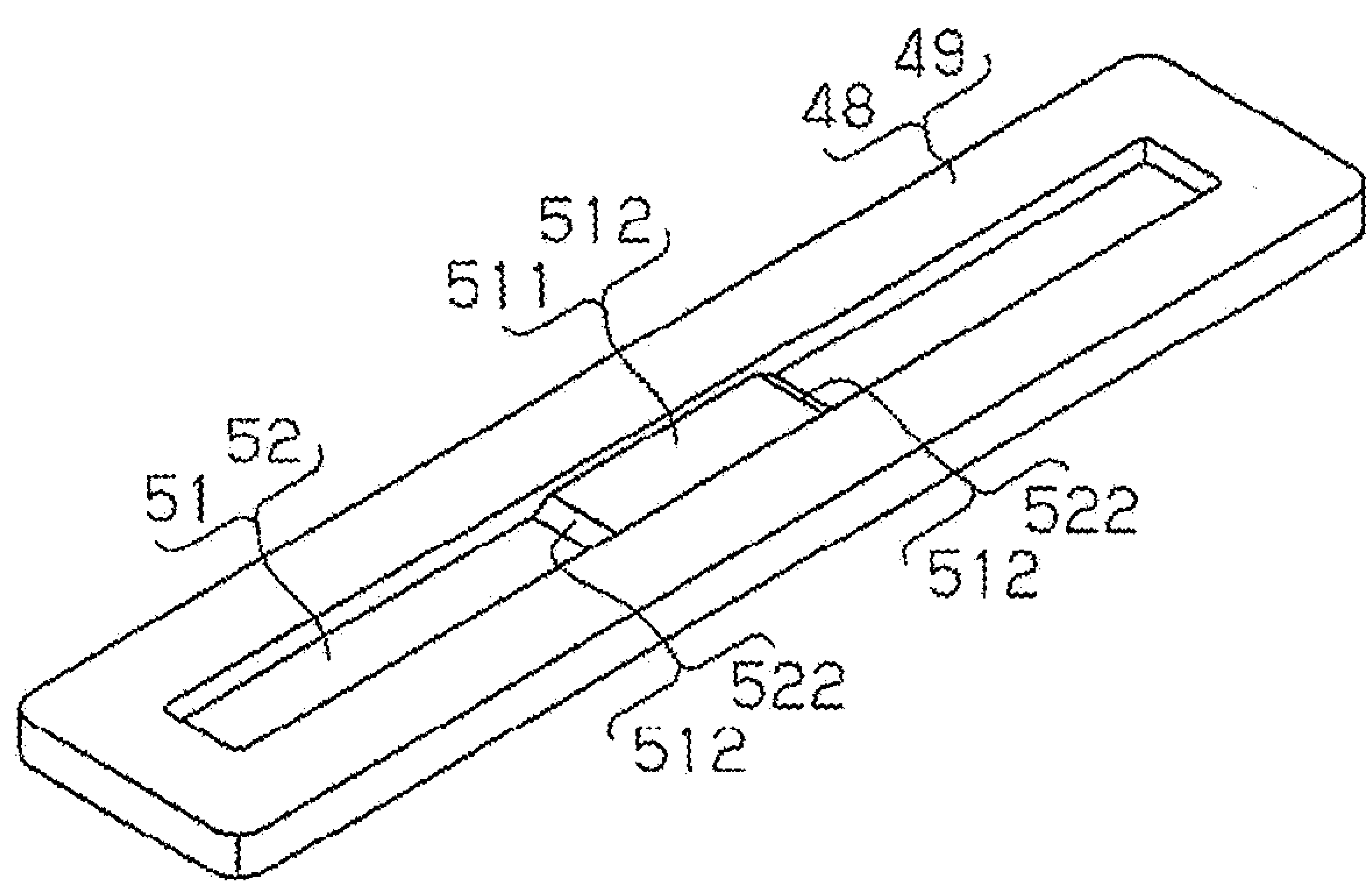

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Fig.10

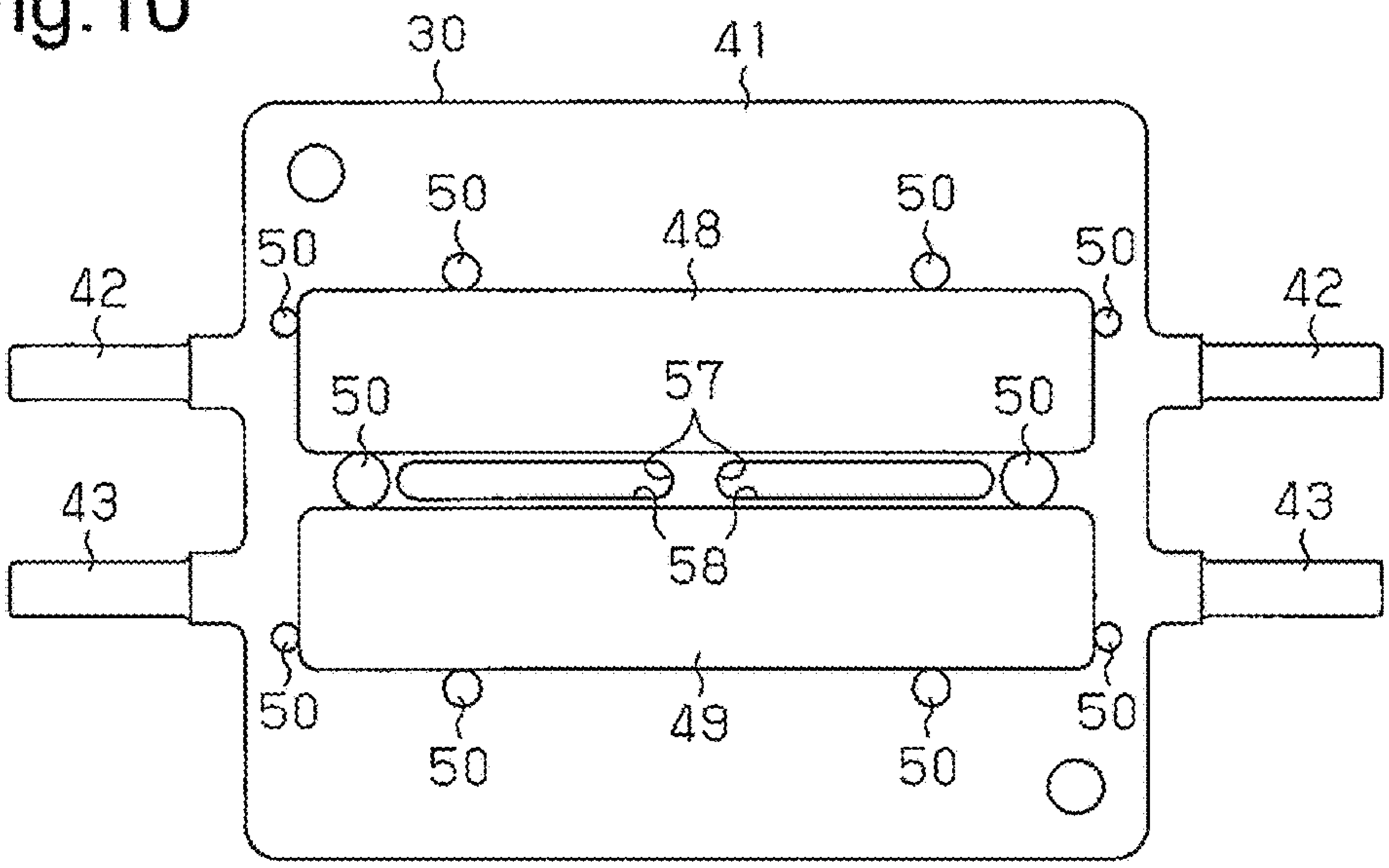


Fig.11

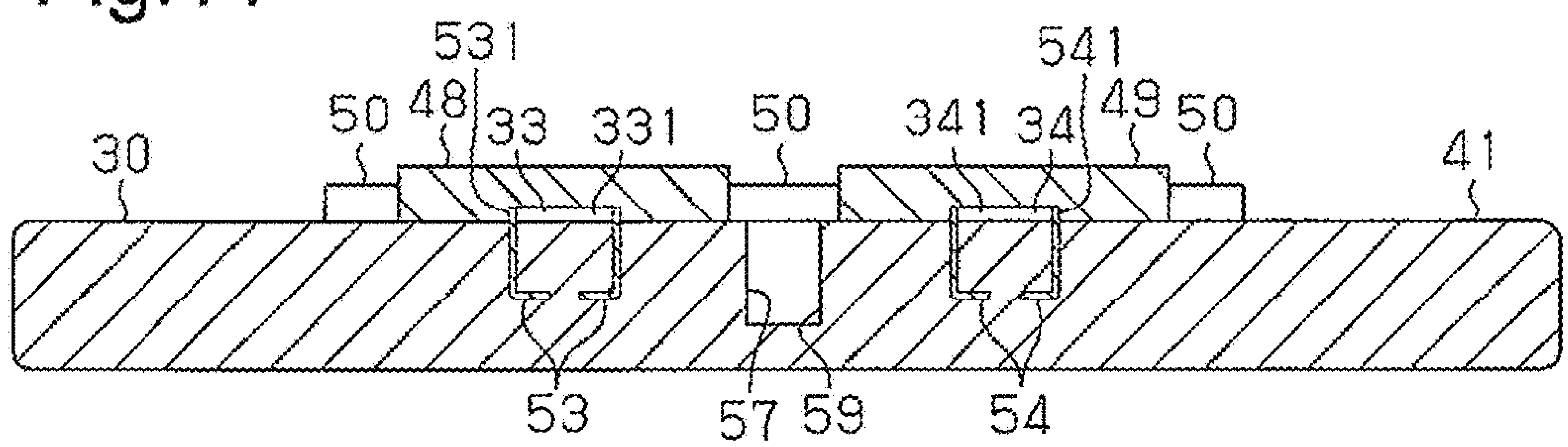


Fig.12

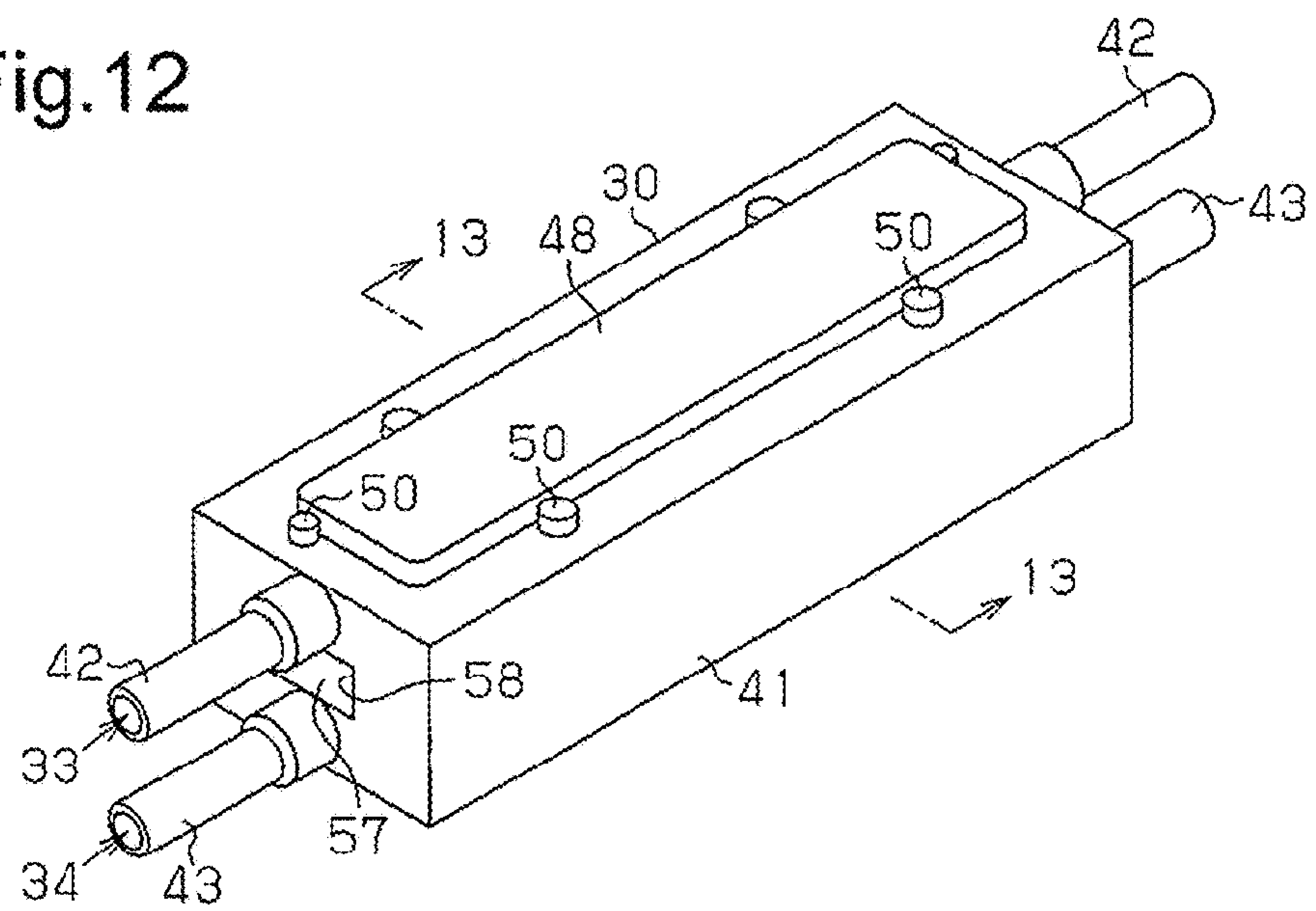


Fig.13

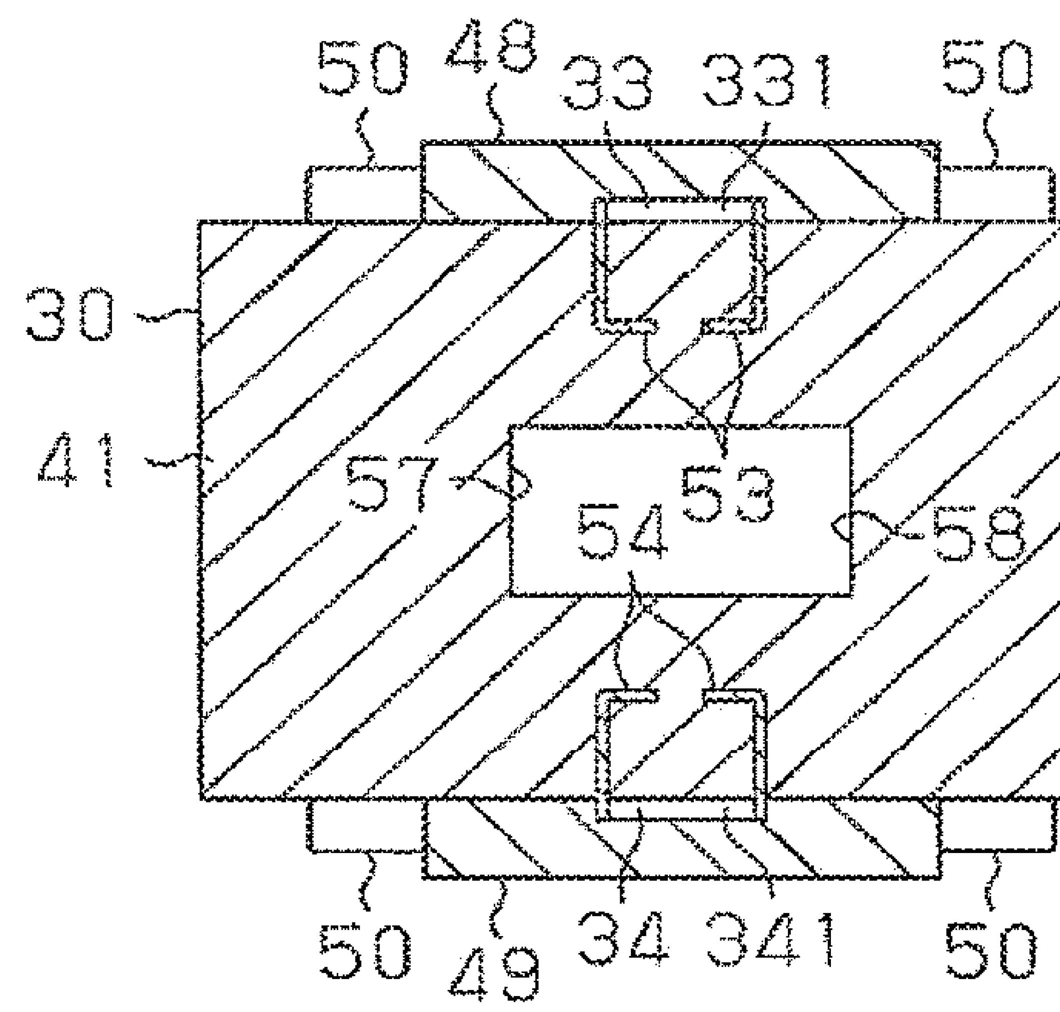


Fig.14

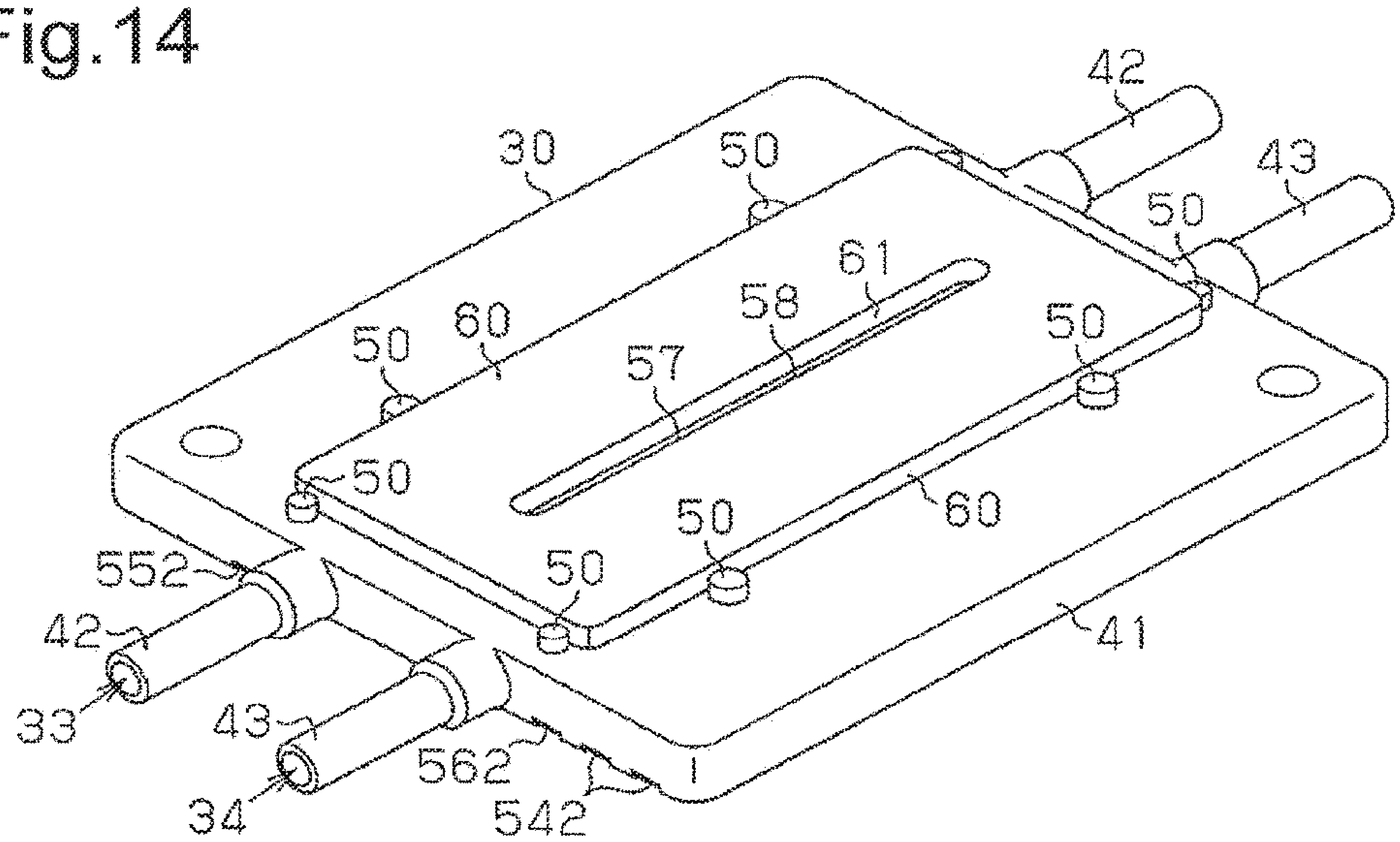
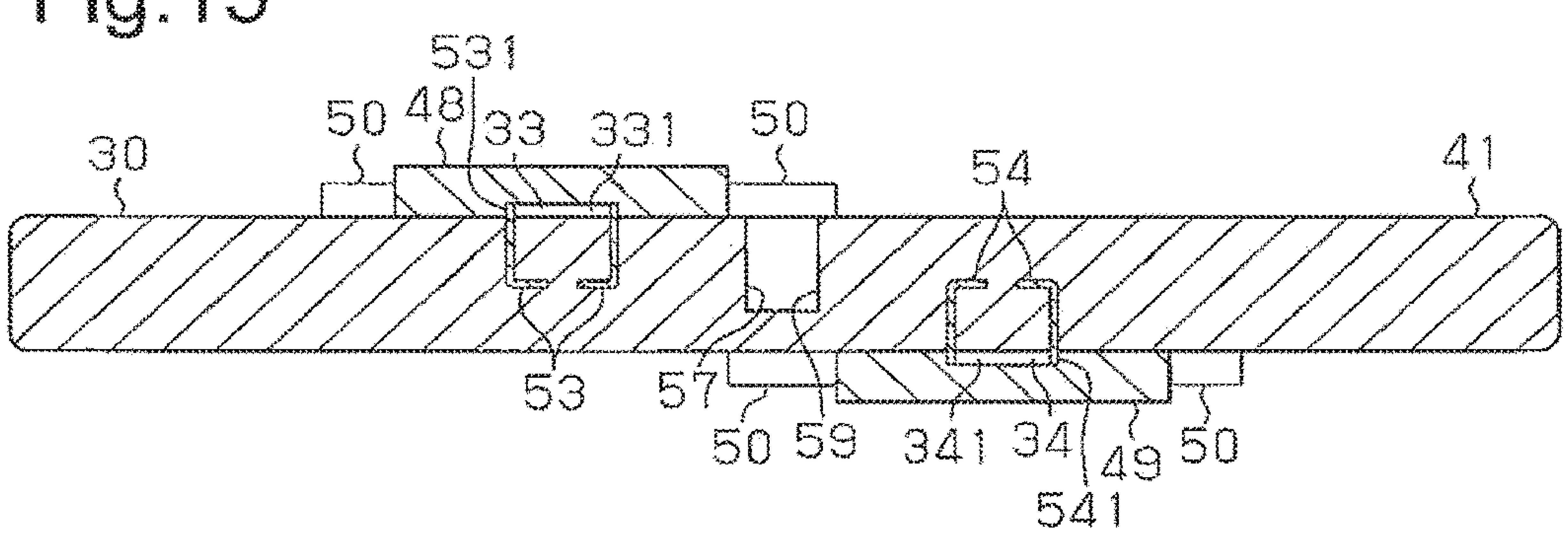


Fig.15



FLOW VOLUME DETECTOR

FIELD OF THE INVENTION

The present invention relates to a flow volume detector incorporated into a medical artificial dialysis apparatus to detect the flow volume of a dialysate.

BACKGROUND OF THE INVENTION

A flow volume detector of this type is disclosed in Patent Document 1. The flow volume detector disclosed in this document comprises a synthetic resin base which is attached to/detached from a flow volume measuring device. A pair of flow channels, in which a dialysate flows, is formed in the base. The base is provided with a detection terminal and an earth terminal in order to detect the flow volumes of the dialysates flowing in the respective flow channels.

One of the pair of flow channels is connected to an inflow route for conducting a dialysate into a dialyzer of an artificial dialysis apparatus in the state where the flow volume detector is attached to the flow volume measuring device. The other flow channel is connected to a return route for returning the dialysate from the dialyzer. The respective flow channels are arranged between a pair of magnetic poles of a magnetic circuit including an electromagnetic coil in the flow volume measuring device.

When the artificial dialysis apparatus is operated in this state, blood containing waste matter derived from a patient is introduced into the dialyzer and filtered. After transfer of the waste matter and moisture separated by filtration into the dialysate, clean blood after dialysis is returned to the patient again. At this time, electromotive forces, which are proportional to the flow rates of the dialysates flowing in the respective flow channels, are developed. The electromotive forces are detected by the respective detection terminals, and the flow volumes of the dialysates flowing in the respective flow channels are measured based on the flow rates of the dialysates and the sectional areas of the flow channels. Then, the amount of the waste matter separated from blood is calculated based on the difference between the flow volumes of the dialysates flowing in the respective flow channels.

According to the flow volume detector disclosed in this document, the pair of flow channels is formed adjacent to each other. Therefore, the base may be deformed if the temperature of a fluid flowing in one of the pair of flow channels becomes high. This is likely to cause a change in sectional area of the other of the pair of flow channels, resulting in the occurrence of an error in the measurement of the flow volume of the dialysate.

PRIOR ART DOCUMENTS

Patent Documents

Patent Document 1: Japanese Laid-Open Patent Publication No. 2011-191069

SUMMARY OF THE INVENTION

An object of the present invention is to prevent the temperature of a fluid flowing in one flow channel from affecting the other flow channel, i.e., to provide a flow volume detector which can appropriately hold the sectional areas of the respective flow channels and can also accurately measure the flow volumes of fluids flowing in the respective channels.

In order to attain the above object, according to a first aspect of the present invention, there is provided a flow volume detector comprising a base, a plurality of flow channels formed in the base and detecting sections which detect the flow volumes of fluids flowing in the plurality of flow channels. A blocking section for blocking heat conduction between the flow channels is provided between the plurality of flow channels.

According to this configuration, the temperature of a fluid flowing in one flow channel may change in some cases. Even in such a case, heat conduction from one flow channel to the other flow channel is blocked by the blocking section provided between the flow channels. Thus, the temperature of the fluid flowing in the one flow channel does not affect the other flow channel. This makes it possible to suitably hold the sectional areas of the respective flow channels and to accurately measure the flow volumes of the fluids flowing in the flow channels.

In the flow volume detector, the blocking section is preferably configured of a groove formed in the base.

In the flow volume detector, the groove preferably penetrates from the front face of the base to its back face.

In the flow volume detector, the detecting sections are preferably arranged in the center part in the longitudinal direction of the groove.

In the flow volume detector, preferably, orifice-shaped measurement flow generating sections are formed in the flow channels, and the detecting sections are arranged in the measurement flow generating sections.

In the flow volume detector, preferably, in the measurement flow generating sections, inclined parts are formed in both end parts in a direction in which fluids flow, and the inclined parts are formed such that the flow channels become narrower as the flow channels go toward the measurement flow generating sections.

In the flow volume detector, preferably, the detecting sections have terminals arranged in end parts on both sides in the width direction of the measurement flow generating sections, and the terminals preferably detect electromotive forces developed by flowing fluids.

In the flow volume detector, preferably, the plurality of flow channels are configured by a pair of flow channels, and the pair of flow channels are respectively arranged in the same plane on both sides of the groove and sandwiching the groove.

According to the present invention, the temperature of a fluid flowing in one flow channel is prevented from affecting the other channel, thereby making it possible to suitably hold the sectional areas of the respective flow channels and to accurately measure the flow volumes of the fluids flowing in the flow channels.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic block diagram showing a medical artificial dialysis apparatus into which a flow volume detector according to a first embodiment of the present invention is incorporated.

FIG. **2** is a perspective view of the flow volume detector.

FIG. **3** is a plan view of the flow volume detector.

FIG. **4** is a cross sectional view along a **4-4** line in FIG. **3**.

FIG. **5** is a cross sectional view along a **5-5** line in FIG. **4**.

FIG. **6** is a cross sectional view along a **6-6** line in FIG. **3**.

FIG. **7** is a perspective view showing the state where the flow volume detector is decomposed into a base and a lid plate.

FIG. **8** is a perspective view showing a detection terminal and an earth terminal of the flow volume detector.

FIG. **9** is a perspective view of the lid plate of the flow volume detector when viewed from the rear side.

FIG. **10** is a plan view showing a flow volume detector according to a second embodiment of the present invention.

FIG. **11** is a cross sectional view showing a flow volume detector according to a third embodiment of the present invention.

FIG. **12** is a perspective view showing a flow volume detector according to a fourth embodiment of the present invention.

FIG. **13** is a cross sectional view along a **13-13** line in FIG. **12**.

FIG. **14** is a perspective view showing a flow volume detector according to a fifth embodiment of the present invention.

FIG. **15** is a cross sectional view showing a flow volume detector according to a sixth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment

Hereinafter, a first embodiment of a flow volume detector according to the present invention will be explained in accordance with FIGS. **1** to **9**.

As shown in FIG. **1**, an artificial dialysis apparatus **21** comprises a dialyzer **22**. Upon operation of a pump **23**, blood **24** containing waste matter **241** derived from the body of a patient is introduced into the dialyzer **22** via a blood circulation route **25**. When the blood **24** is filtered by the dialyzer **22**, the waste matter **241** in the blood is separated and taken in a dialysate **26** as a fluid. The clean blood **24** after filtration is returned to the patient's body.

The artificial dialysis apparatus **21** further comprises a flow volume measuring device **27**. The flow volume measuring device **27** is provided with a magnetic circuit **28** comprising an electromagnetic coil **281** and a pair of magnetic poles **282** and a signal processing circuit **29** for processing a measurement signal. An alternating current is supplied to the electromagnetic coil **281**.

A disposable type flow volume detector **30** is attached to the flow volume measuring device **27** in order to measure the flow volume of a dialysate **26**. The flow volume detector **30** is configured to be attachable to/detachable from the flow volume measuring device **27**. The flow volume detector **30** is provided with a pair of flow channels **33**, **34**. The flow channels **33**, **34** are connected to an inflow route **31** and a return route **32**, respectively, for the dialysate **26** with respect to the dialyzer **22**.

Both the flow channels **33**, **34** are arranged between both the magnetic poles **282** of the magnetic circuit **28** in the state where the flow volume detector **30** is attached to the flow volume measuring device **27**. Upon operation of the pump **35** in this state, the dialysate **26** is allowed to flow into the dialyzer **22** via the inflow route **31** and flow channel **33** from a supply tank **36**. The dialysate **26** containing the waste matter **241** separated by the dialyzer **22** is returned to a drain tank **37** via the return route **32** and flow channel **34**. At this time, the flow volumes of the dialysates **26** flowing in the respective flow channels **33**, **34** are respectively measured by the flow volume detector **30**.

As shown in FIGS. **2** and **3**, the flow volume detector **30** comprises a base **41** made of a transparent synthetic resin such as a polypropylene resin. The base **41** is formed into a rectangular plate form. From both end faces of the base **41**, a pair of connection pipes **42**, **43** is respectively protruded. The respective connection pipes **42**, **43** are connected to the middle of the inflow route **31** and return route **32**. As shown in FIG. **4**, concave parts **46**, **47**, which are in communication with passages **44**, **45** within the respective connection pipes **42**, **43**, are formed in both end parts of the base **41**. The passages **44**, **45** are connected to the concave parts **46**, **47**, respectively, in positions slightly higher than the bottom faces of the concave parts **46**, **47**. Groove parts **461**, **471** are formed at sites near to the center of the base **41** in the concave parts **46**, **47**. The groove parts **461**, **471** are shallower than the concave parts **46**, **47** and are arranged in positions higher than the passages **44**, **45**.

As shown in FIGS. **2** and **6**, a part of lid plates **48**, **49** are adhered or welded onto the upper face of the base **41**. The lid plates **48**, **49** are formed of a transparent synthetic resin such as a polypropylene resin. The respective lid plates **48**, **49** are positioned in predetermined positions on the base **41** by a plurality of positioning pins **50**. As shown in FIG. **4**, measurement groove parts **51**, **52**, which are in communication with the concave parts **46**, **47** and groove parts **461**, **471**, are formed on the back face of the respective lid plates **48**, **49**. Convex parts **511**, **521** are formed in the center parts in the longitudinal direction of the respective measurement groove parts **51**, **52**. Inclined parts **512**, **522** are formed in both end parts of the convex parts **511**, **521**.

As shown in FIGS. **4** and **5**, the flow channel **33** is configured of the passage **44** of the connection pipe **42**, the concave part **46**, the groove part **461** and the measurement groove part **51** of the lid plate **48** in a state where the lid plates **48**, **49** are fixed on the base **41**. Also, the flow channel **34** is configured of the passage **45** of the connection pipe **43**, the concave part **47**, the groove part **471** and the measurement groove part **52** of the lid plate **49**. Orifice-shaped measurement flow generating sections **331**, **341** are formed between the convex parts **511**, **521** of the respective lid plates **48**, **49** and the upper face of the base **41**. The respective measurement flow generating sections **331**, **341** have passage sectional areas suitable to generate the measurement flows of the dialysates **26** in the respective flow channels **33**, **34**.

As shown in FIGS. **5**, **7**, and **8**, a pair of detection bus bars **53** and a pair of detection bus bars **54** are embedded within the base **41**. A detection terminal **531** as a detecting section, which is exposed within the measurement flow generating section **331**, is formed in the first end of the respective detection bus bars **53**. A detection terminal **541** as a detecting section, which is exposed within the measurement flow generating section **341**, is formed in the first end of the respective detection bus bars **54**. The detection terminals **531**, **541** are arranged opposite to each other in end parts in the width direction of the measurement flow generating sections **331**, **341**. As shown in FIGS. **2** and **8**, connection terminals **532**, which are exposed to the end face of the base **41**, are respectively formed in the second end parts of the respective detection bus bars **53**. Connection terminals **542**, which are exposed to the end face of the base **41**, are respectively formed in the second end parts of the respective detection bus bars **54**. The connection terminals **532**, **542** are connected to a signal processing circuit **29** of the flow volume measuring device **27**.

Within the base **41**, an earth bus bar **55** and an earth bus bar **56** are embedded. Earth terminals **551**, **561**, which are exposed within the groove parts **461**, **471**, are respectively formed in the first end parts of the respective earth bus bars **55**, **56**. Connection terminals **552**, **562**, which are exposed to the end face of the base **41**, are respectively formed in the second end parts of the respective earth bus bars **55**, **56**. The connection terminals **552**, **562** are connected to the signal processing circuit **29**.

As shown in FIGS. **3** and **6**, a blocking section **57** is provided in the center between both the flow channels **33**, **34** in the base **41**. The blocking section **57** blocks heat conduction from one of the pair of flow channels **33**, **34** through the base **41** to the other flow channel. In the first embodiment, the blocking section **57** extends along the flow channels **33**, **34** between both the flow channels **33**, **34**. Namely, the blocking section **57** is configured of a through groove **58** penetrating from the front face of the base **41** toward its back face. Both the flow channels **33**, **34** are arranged in the same plane on both sides sandwiching the through groove **58**. The detection terminals **531**, **541** are arranged in the center part in the longitudinal direction of the through groove **58**.

Next, the action of the artificial dialysis apparatus including the flow volume detector **30** described above will be explained.

As shown in FIG. **1**, the flow volume detector **30** is attached to the flow volume measuring device **27** when the artificial dialysis apparatus **21** is used. In this state, the flow channel **33** is connected to the middle of the inflow route **31**, and the flow channel **34** is connected to the middle of the return route **32**. In this state, the measurement flow generating sections **331**, **341** of the respective flow channels **33**, **34** shown in FIG. **4** are arranged between the pair of magnetic poles **282** of the magnetic circuit **28**.

Upon operation of the artificial dialysis apparatus **21** in this state, the blood **24** derived from a patient is introduced into the dialyzer **22** via the blood circulation route **25** by actuation of the pump **23**. Also, the dialysate **26** within the supply tank **36** is allowed to flow into the dialyzer **22** via the inflow route **31** and flow channel **33** by actuation of the pump **35**. Therefore, the blood **24** is filtered with the dialyzer **22**, and, simultaneously, the waste matter **241** in the blood **24** is separated and transferred into the dialysate **26**. The cleaned blood **24** is returned to the patient via the blood circulation route **25**. Also, the dialysate **26** containing the waste matter **241** is recovered to a drain tank **37** via the return route **32** and flow channel **34**.

At this time, an alternating field is generated by an alternating current in the magnetic circuit **28**. The magnetic flux penetrates the measurement flow generating sections **331**, **341** of the respective flow channels **33**, **34**. Therefore, electromotive forces corresponding to the flow rates of the dialysates **26** flowing in the measurement flow generating sections **331**, **341** are developed. The electromotive forces are output as detection signals from the detection terminals **531**, **541** of the respective detection bus bars **53**, **54** to the signal processing circuit **29**. The detection signals are output at a level set according to the earth potential from the earth bus bars **55**, **56**. From the detection signals, the flow volumes per unit time of the dialysates **26** flowing in the respective flow channels **33**, **34** are respectively measured from the detection signal based on the flow rates of the dialysates **26** and the sectional areas of the measurement flow generating sections **331**, **341**. The amount of the waste matter **241** separated from the blood **24** is calculated based on the difference between the flow volumes of the dialysates **26** flowing in both the flow channels **33**, **34**.

In the measurement of the flow volumes of the dialysates **26**, when the temperature of the dialysate **26** flowing in one of the flow channels **33**, **34** changes, the base **41** made of a synthetic resin and the lid plate **48** may expand or contract. This is likely to cause a change in sectional area of the measurement flow generating sections **331**, **341** in the other of the flow channels **34**, **33**, resulting in the occurrence of an error in the measurement of the flow volume. In this regard, according to the first embodiment, the through groove **58** is formed as the blocking section **57** for substantially blocking heat conduction between both the flow channels **33**, **34** on the base **41**. Therefore, the temperature of the dialysate **26** flowing in one of the flow channels **33**, **34**, even if changed, hardly affects the other flow channel by virtue of the through groove **58**.

Accordingly, the first embodiment can provide the following advantageous effects.

(1) The blocking section **57** for blocking heat conduction between the flow channels **33**, **34** is provided between the flow channels **33**, **34**. Therefore, even if the temperature of the dialysate **26** flowing in one of the flow channels **33**, **34** changes, heat conduction from the one flow channel to the other flow channel is blocked by virtue of the blocking section **57**. Accordingly, the temperature of the dialysate **26** flowing in one of the flow channels **33**, **34** hardly affects the other flow channel. Thus, it is possible to appropriately hold the sectional areas of the respective flow channels **33**, **34** and to accurately measure the flow volumes of the dialysates **26** flowing in the flow channels **33**, **34**.

(2) The blocking section **57** is configured of the through groove **58** formed in the base **41**. This configuration ensures a simple structure of the blocking section **57** and effective blocking of heat conduction between the flow channels **33**, **34**.

(3) The through groove **58** penetrates from the front face of the base **41** toward its back face. Therefore, it is also possible to block heat conduction between the flow channels **33**, **34** at a high level and to maintain a high blocking rate.

(4) The inclined parts **512**, **522** are formed in both end parts of the convex parts **511**, **521** forming the measurement flow generating sections **331**, **341**. This configuration makes the flow of the dialysates **26** difficult to be disturbed even if the sectional areas of the flow channels in the concave parts **511**, **521** and on both sides of the convex parts **511**, **521** are different. Therefore, the flow volumes of the dialysates **26** can be accurately detected.

(5) The concave parts **46**, **47** and groove parts **461**, **471** are formed between the passages **44**, **45** of the connection pipes **42**, **43** and the measurement groove parts **51**, **52** of the lid plates **48**, **49**. According to this configuration, the dialysates **26** are temporarily stored in the concave parts **46**, **47** and the groove parts **461**, **471**. This makes the flow of the dialysates **26** difficult to disturb. Therefore, the flow volumes of the dialysates **26** can be accurately detected.

(6) The detection terminals **531**, **541** of the detection bus bars **53**, **54** are arranged in the center in the longitudinal direction of the through groove **58**. In this case, the detection terminals **531**, **541** are arranged in positions which are difficult to be affected by heat from a flow channel different from the flow channel in which the detection terminals are arranged. This makes it possible to accurately detect the flow volumes of the dialysates **26**.

(7) The flow channels **33**, **34** are arranged in the same plane on both sides sandwiching the through groove **58**. Therefore, it is possible to form the flow volume detector **30** in a flat and compact shape.

Second Embodiment

Next, a second embodiment of the flow volume detector **30** according to the present invention will be explained with reference to FIG. **10**. The second and subsequent embodiments and altered examples will be explained mainly in terms of their differences from the first embodiment.

A through groove **58** as a blocking section **57** is divided into two parts in the longitudinal direction, as shown in FIG. **10**.

Thus, the second embodiment can provide the following advantageous effect.

(8) Since the length of one through groove **58** is made shorter, it is possible to suppress the deformation of a portion between the measurement groove parts **51**, **52** of the base **41**. Accordingly, the reinforcing action of the base **41** can be obtained.

Third Embodiment

Next, a third embodiment of the flow volume detector **30** according to the present invention will be explained with reference to FIG. **11**.

As shown in FIG. **11**, a blocking section **57** is configured of a concave groove **59** formed in the upper face of the base **41**. The concave groove **59** has a bottom wall. The concave groove **59** are provided between both flow channels **33**, **34** and extend along the flow channels **33**, **34**.

Thus, the third embodiment can provide the following advantageous effect.

(9) Since the concave groove **59** has a bottom wall, it is possible to suppress the deformation of the base **41** as a whole and to obtain the reinforcing effect of the base **41**.

Fourth Embodiment

Next, a fourth embodiment of the flow volume detector **30** according to the present invention will be explained with reference to FIG. **13**.

As shown in FIGS. **12** and **13**, a pair of flow channels **33**, **34** is formed such that they are spaced apart in the thickness direction of a base **41** and overlap each other. A through groove **58** as a blocking section **57** is provided between the flow channels **33**, **34**. The through groove **58** penetrates from one of both ends of the base **41** to the other.

Thus, the fourth embodiment can provide the following advantageous effect.

(10) The flow channels **33**, **34** are formed on both sides of the through groove **58** and sandwiching the through groove **58** such that they overlap each other in the thickness direction of the base **41**. This configuration makes it possible to narrow the width of the base **41** and downsize the entire base **41**. Since it is also possible to flow a cooling medium in the through groove **58**, the temperature of the flow volume detector **30** can be managed more easily.

Fifth Embodiment

Next, a fifth embodiment of the flow volume detector **30** according to the present invention will be explained with reference to FIG. **14**.

As shown in FIG. **14**, one lid plate **60** is employed in place of the pair of lid plates **48**, **49** in the respective embodiments described above. A through groove **61** as a blocking section which penetrates from the front face of the lid plate **60** toward its back face is formed in the center part of the lid plate **60**. The through groove **61** is formed in a position corresponding to the through groove **58** of the base **41**. The through groove **61** has almost the same width and length as those of the through groove **58**.

Thus, the fifth embodiment can provide the following advantageous effect.

(11) Since only one lid plate **60** is formed, it is possible to reduce the number of parts to simplify the configuration of the flow volume detector.

Sixth Embodiment

Next, a sixth embodiment of the flow volume detector **30** according to the present invention will be explained with reference to FIG. **15**.

As shown in FIG. **15**, one of the pair of lid plates **48**, **49** is attached to a surface of a base **41** opposite to another surface thereof to which the other lid plate is attached. Therefore, also for a pair of flow channels **33**, **34** and detection bus bars **53**, **54**, one of the flow channels or detection bus bars is provided on a surface of the base **41** opposite to another surface thereof on which the other flow channel or detection bus bar is provided.

Thus, the sixth embodiment can provide the following advantageous effect.

(12) One of the pair of flow channels **33**, **34** is provided on a surface of the base **41** opposite to another surface thereof on which the other flow channel is provided. According to this configuration, it is possible to further suppress the temperature of the fluid flowing in one of the pair of flow channels **33**, **34** from affecting the other flow channel because of a long distance between the flow channels **33**, **34**.

In the meantime, the above-described embodiments may be changed as follows.

A heat insulating material such as expanded polystyrene may be packed within the through groove **58** or concave groove **59**. That is, the blocking section **57** may be configured of the through groove **58** or concave groove **59** and the heat insulating material.

A plurality of small holes may be linearly and continuously formed to configure the blocking section **57**.

The flow volume detector according to the present invention may be used in fields other than artificial dialysis.

The invention claimed is:

1. A flow volume detector which measures the flow volume of a dialysate in an artificial dialysis apparatus, the flow volume detector comprising:

a base,

a plurality of flow channels formed in the base;

a lid plate fixed to an upper face of the base; and

detecting sections arranged in the flow channels for detecting flow volumes of fluids flowing in the plurality of flow channels,

wherein a blocking section for blocking heat conduction between the plurality of flow channels is provided between the plurality of flow channels,

the blocking section is configured of a space including at least a groove formed through the base, the groove penetrates from a front face of the base toward a back face of the base.

2. The flow volume detector according to claim **1**, wherein the blocking section is configured of a first groove formed through the base and a second groove formed in a position corresponding to the first groove in the lid plate.

3. The flow volume detector according to claim **1**, wherein the detecting sections are arranged in a center part in a longitudinal direction of the groove.

4. The flow volume detector according to claim **1**, wherein orifice-shaped measurement flow generating sections are formed in the flow channels, and the detecting sections are arranged in the measurement flow generating sections.

5. The flow volume detector according to claim **4**, wherein, in the measurement flow generating sections, inclined parts are formed in both end parts in a direction in which fluids flow, and the inclined parts are formed such that the flow channels become narrower as the flow channels go toward the measurement flow generating sections.

6. The flow volume detector according to claim **4**, wherein the detecting sections have terminals arranged in end parts on both sides in a width direction of the measurement flow generating sections, and the terminals detect electromotive forces developed by flowing fluids.

7. The flow volume detector according to claim **1**, wherein the plurality of flow channels are configured of a pair of flow channels, and the pair of flow channels are respectively arranged in the same plane on both sides of the groove and sandwiching the groove.

8. A flow volume detector which measures the flow volume of a dialysate in an artificial dialysis apparatus, the flow volume detector comprising:

a base,

a plurality of flow channels formed in the base;

a lid plate fixed to an upper face of the base; and

detecting sections arranged in the flow channels for detecting flow volumes of fluids flowing in the plurality of flow channels,

wherein a blocking section for blocking heat conduction between the plurality of flow channels is provided between the plurality of flow channels,

the blocking section is configured of a space including at least a groove formed in the base, the groove penetrates from a front face of the base toward a back face of the base, and

wherein the flow channels comprise passages of connection pipes protruding from both end faces of the base, concave parts which are formed in both end parts of the base and are in communication with the passages of the connection pipes, groove parts formed at locations near to the center of the base in the concave parts, and measurement flow generating sections formed in an upper face of the base, wherein the groove parts are shallower than the concave parts and are arranged in positions higher than the passages, and the measurement flow generating sections are arranged in positions higher than the groove parts.

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